

Section 3. Interface Control Process

3.1 Roles and Responsibilities

The ESDIS Project is responsible for the implementation and operation of the EGS. The ESDIS Project is the focus for the requirements and operations needs of the flight projects, domestic and international partners, and science users of the EGS. High-level requirements documents, mission statements, and cooperative agreements are provided by NASA Headquarters and the GSFC Mission to Planet Earth (MTPE) Office to the ESDIS Project for implementation. These high-level requirements and other information are expanded and augmented as necessary by the ESDIS Project into EOSDIS requirements documents and MOUs, IPAs, project implementation plans, and project data management plans. From this requirements base, and in response to the allocation of these requirements into implementation and operations activities, the interfaces to be controlled are conceived and defined. As the functional and performance requirements for each interface become known and agreed on, those requirements are included in each individual activity's functional and performance specifications, making the creation of interface documentation that much easier. The *ESDIS Project Requirements Management Plan* (see Section 1.3, Reference 9) defines the process for managing the requirements.

Another important aspect of the interface definition process is the identification of the interfaces that are to be controlled and at what level. This step involves the cooperating projects and requires consistency among the many agreements, contractual documents, and requirements and specifications. The controlling authority within the ESDIS Project is the ESDIS CCB, and the process that is followed is described in the *ESDIS Configuration Management Plan* (see Section 1.3, Reference 8). Since mid-1996, most of the work of the ESDIS CCB for interface documentation is allocated to the ICWG to perform, and to that end the ICWG works closely with the Configuration Management Office (CMO), which is the administrative arm of the ESDIS CCB. The ICWG interface documentation control process follows the same procedures as the ESDIS CCB.

The ESDIS Project, through its System Management Office, has established the ICWG to facilitate the development and approval of interface documents and to provide oversight of the interface development process. The Chairperson of the ICWG is the Interface Manager of the System Management Office. This System Interface Control Plan defines the work of the ICWG.

The implementing and operating organizations also have an important role to play in the interface control process, in that they are the interfacing organizations whose interfaces must be defined and controlled to function properly. Members of these organizations are the authors of lower level requirements and the interface documents. Assigned functional and performance requirements and their expanded expression of requirements are defined in IRDs. IRDs are approved at the ESDIS Project level to ensure their compatibility with assigned requirements and for consistency of cost, schedule, and performance. IRDs identify subordinate ICDs, and these are subsequently developed by the interfacing organizations to further define the physical and performance parameters of the exact designs that will be implemented and used. Each organization that is a party to an IRD or ICD manages its approval of that IRD or ICD, and the ESDIS Project in turn performs configuration management of the document. The interfacing organizations implement the interfaces in accordance with the designs disclosed in their ICDs,

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demonstrate that the interfaces perform the functions required by the interface requirements, and maintain configuration control of designed and implemented interfaces.

Each EOSDIS Project or contract organization has interface management responsibilities for tracing its functional and performance requirements down to its interface design requirements. In addition, the projects are responsible for verifying that the design of the interface and the implemented interface meet those design requirements. Each organization defines its methods for formal verification for each requirement in the requirements document. These verification methods and the results of the verification process are presented at formal reviews, leading to acceptance of the interface for operations. The operational functionality of the interfaces is demonstrated to the ESDIS Project by operating the systems through the interfaces to show that selected operational scenarios can be performed.

The Independent Verification and Validation (IV&V) contractual effort verifies that the configured interfaces meet the approved IRDs and the functional and performance specifications.

The *Independent Verification and Validation Plan* (see Section 1.3, Reference 12) defines the interface document verification process. The IV&V contractor analyzes IRDs and ICDs using the methodologies defined in the IV&V Plan. Technical analysis memoranda and technical analysis reports are prepared and delivered to document the analysis findings. IRD analysis results are captured in an Automated Requirements Database (ARDB). Interface data definitions are captured in an Interface Analysis Database (IADB). Interface issues are captured in the Project Issues Tracking System (PITS).

3.2 Interface Control Working Group

This ICP establishes the ICWG. The ICWG verifies that the development of the interfaces is proceeding as needed for orderly integration of EOSDIS and the EGS.

The goals of the ICWG are to

- Coordinate technical approval of EOSDIS data interface requirements for use by implementation contractors
- Facilitate interfacing projects' approval of interface control documents to control interface designs
- Routinely assemble interface management data for the ESDIS Project managers

The purposes of the ICWG are to

- Track ESDIS IRDs, ICDs, and DFCDs and the issues associated with them
- Provide a technical review of IRDs and ICDs/DFCDs
- Conduct documentation approval meetings to approve all interface documents for the ESDIS Project
- Coordinate the ICWG documentation approval activities with the CMO as part of the ESDIS CCB process

The ICWG is composed of MTPE and ESDIS management personnel and representatives of each of the projects and contracts with EOSDIS interfaces. The membership of the ICWG changes as new projects develop, new interfaces are identified, and current projects and interfaces move into their operational phases. At present, the membership of the ICWG is as shown in Table 3-1. Regular members are shown from NASA or other government agencies and from the EGS contractor community. The Other column shows ESDIS representative support and special (temporary) invitees. The ICWG Chairperson coordinates the attendance to ensure that each agenda's topics are fully represented.

Attendance at ICWG meetings varies depending on what was in the previously distributed agenda. Attendees often represent multiple activities; e.g., one or two representatives are from the systems implementation team discipline. The mailing list for ICWG meeting minutes and meeting agendas is substantially larger than the membership list, so ICWG activities are widely known. Book authors, book bosses, and CCB members are frequent attendees.

At the discretion of the Chairperson, two or more ICWG meetings are scheduled each month. One meeting is a status reporting meeting. This meeting's standard agenda is to determine the status of interface documentation and identify issues concerning interfaces. A second meeting is to discuss special topics aimed at resolving selected issues with the relevant representatives. Documentation Approval meetings can occur as part of the status and/or special topic meetings, or as separate meetings. These meetings are uniquely identified when the ICWG considers interface documentation for CCB approval.

The standard topics for the monthly ICWG status meeting are as follows:

1. Changes to the ESDIS IRD Master Schedule (Figure C-1) and the ESDIS ICD Master Schedule (Figure C-2) since the previous meeting—Each Project Representative
2. Changes to the ESDIS IRD Listing (Figure C-4) and the ESDIS ICD Listing (Figure C-5)—Each Project Representative
 - Document name, title, number changes
 - Current status changes
 - New interfaces/documents
 - TBD/TBR status and plans
3. Review and update of the PITS interface issues
4. Identification of new action items
5. Review of old action item status
6. Identification of special topics and representatives required for subsequent special topics and Documentation Approval meetings

Minutes are distributed electronically after each meeting. Paper copies of the EOSDIS data interfaces diagram, the ESDIS IRD/ICD Master Schedules, and the ESDIS IRD/ICD Listing are provided to the attendees. Representatives presenting material at the meetings are to provide enough copies for attendees. The ICWG maintains an electronic mailing list for the distribution of interface issues, ICWG agendas, minutes, and other documentation of concern to ICWG. Most of the ICWG schedules and status materials and meeting minutes are placed on the World Wide Web (WWW) (http://esdis.gsfc.nasa.gov/syseng/disciplines/interface/if_eng.html).

Table 3-1. Interface Control Working Group Composition (1 of 2)

Project	NASA Member/ Government Member	Contractor Member	Other
MTPE Office	X		
EOS AM	X		
NISS (DSM) GN SDPF DSN WOTS Nascom NCC FDF TGT	X		I I I I I
ETS	X	X	
Ebnet	X		
EDOS	X	X	
ECS FOS CSMS SDPS	X X X X	X X X X	
TRMM Project	X		
TSDIS	X		
NSI	X		
ESDIS Requirements SCFs V0 DAACs I&T Systems Engineer DSM MOM	X X X X X X X X X		
NASDA			E
MITI			E
NOAA Operations			E

NOAA ADC			E
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Table 3-1. Interface Control Working Group Composition (2 of 2)

Project	NASA Member/ Government Member	Contractor Member	Other
IV&V	X	X	
EOS PM	X	X	
Special Projects CERES LIS SAGE III SeaWinds RADAR Alt MR DFA ACRIM SOLSTICE			E
CHEM	X		
LASER ALT			

X = Member

E = ESDIS Representative

I = Invitee

Project representatives are expected to be familiar with the content of the MOUs, IPAs, IRDs, and ICDs covering interfaces with their project. They should plan on providing the current status and plans concerning the documentation, implementation, deployment, and verification at each ICWG meeting. They should prepare and submit the configuration change requests (CCRs) required to baseline the interface documentation in their respective projects or organizations and support the change board meetings there to approve the documents before consideration by the ESDIS Project. In addition, they should support the change board meetings of interfacing organizations that also approve the documents and document changes.

A special IRD/ICD Status Matrix (see Figure C-3) is used to provide a statistical means of tracking planned versus actual document completion. In this matrix, the total IRDs/ICDs are listed by originator. ECS is the largest category, followed by EDOS, EBnet, and Others. Three columns are provided to list totals by development and approval stages: Originating Organization Baseline, ESDIS CCB, and the interfacing organizations. A fourth column is provided for future IRDs/ICDs. Columns are also provided to list both scheduled and completed totals.

To keep the IRD/ICD Status Matrix up to date, the plan is to identify representatives from each originating organization who are to provide information at the ICWG meetings pertaining to the number of IRDs/ICDs that have been completed or are still being developed. The ICWG is responsible for logging all changes provided at the ICWG meeting and then making these changes to the actual matrix.

3.3 Interface Documents—Development, Review, and Approval

The documents are developed to define the interface details within the EGS. The purpose and scope of the interfaces are contained in the ESDIS Project requirements, the payload implementation plans, the IPAs (flight), project data management plans (PDMPs), and interproject-level MOUs. The IRDs are developed to define the Level 3 functional and performance requirements of the interfaces. Appendix A contains an example of an IRD annotated outline. ICDs are prepared as identified in the IRDs and in contractual requirements. Appendix B contains an example of an ICD annotated outline.

The ESDIS Project interface documentation flow is shown in Figure 3-1. From the upper left-hand corner of this figure, the ESDIS Project, other projects and partners, and the ICWG are all shown to be involved in defining interfaces that must be controlled, with attendant contractual documents and agreements forthcoming. From this process, a list of interface documents to be controlled is generated, and the ESDIS Project and ICWG assign Book Boss and Author responsibilities for each document as needed. The Book Boss is an ESDIS Project member who is responsible for representing ESDIS Project interests during the interface development and for facilitating the development, review, and approval of the document and its subsequent changes (if any).

After the Book Boss and authors have been assigned and the interfacing organizations have been identified, the real work of identifying the applicable requirements, expanding these as necessary to fully define the interface and to support system designs, and the capture of these ideas in the interface documentation can proceed. This effort is always iterative, initially focused on achieving an approved baseline and later identifying changes and updates needed to keep pace with program changes and design evolution. The product at this point is an interface document for review. The goal is to have this document free of undetermined parameters or issues but, as a practical matter, a small level of uncertainty or difference in opinion is tolerable if it does not affect the implementation process or schedule. Each document must include these identified issues in a “workoff plan,” which assesses the severity of each problem and the proposed schedule and method toward resolution.

Proposed documents or changes to baseline documents are first submitted locally for lower level approval, typically at the author’s organization. This step establishes each document as sufficiently complete to receive ESDIS Project review and to initiate ICWG tracking of any issues that are present. Documents before the local CCB (e.g., ECS, EBnet, EDOS, Level III or IV CCBs) can be approved and then passed on for ESDIS Project-level review or returned to the author for additional work and/or issues resolution. Approved documents and changes are presented by their sponsor (usually the Book Boss) as candidates for ESDIS Project approval. A CCR is prepared at this time to start the process.

Concurrent with the local review and approval of documents and changes, any issues that exist and are addressed within the documents in the workoff plans are captured into the PITS database to facilitate ICWG tracking and workoff of them. This is one major source of PITS issues; the other is the ICWG and ESDIS Project reviews of interface documentation and implementation and operations progress. The IV&V team is the administrator of the PITS issues database, issuing it and discussing it monthly as part of the regular ICWG activities.

When the Book Boss or sponsor recommends the document or change for ESDIS Project-level review by requesting a CCR, the CMO assigns the CCR number, and the ICWG schedules the

document/CCR for consideration of approval. Documents, changes, and CCRs are made available electronically and in hardcopy form, often on multiple servers and on the WWW. The agenda for the forthcoming documentation approval meeting (as part or all of an ICWG meeting) is widely announced.

During the following few weeks, until the ICWG meeting, the CCR/document/change is reviewed and commented on by the entire ICWG community. Any additional issues are identified, and implementing organizations are asked for impact statements and rough-order-of-magnitude (ROM) estimates for any impacts identified. All these responses are considered at the documentation approval meeting, where consensus decisions are made on whether the document or change should be approved or deferred for a major issue, for more work, or for incomplete review. At the meeting, as an alternative, comment changes, errata, or actions may be assigned for conditional approval. Decisions and discussions at the documentation approval meetings are documented in ICWG meeting minutes, which are reviewed by selected ICWG members and approved by the Interface Manager. All errata, comments, and actions are also documented in these minutes. The approved minutes are distributed to those on the ICWG distribution list and are placed on servers and the WWW.

After the ICWG has approved the CCR/document/change, the minutes have been prepared and approved, and all actions, errata, and comments have been taken care of, the CMO and ESDIS Project provide final edit and posting of the documents and final signoff. Coordination with interfacing organizations is often a joint effort among the authors, Book Boss, ICWG members, and the projects. Throughout this process, and especially after document approval, the ICWG status and schedule charts are updated, distributed, and made available as discussed in Section 3.2.

3.3.1 Author's Tasks

The author performs the following:

- Schedules coordination meetings with interfacing organization's representatives and the ESDIS representative. This group—the author's organization representative, the ESDIS representative, and the interfacing organization's representative—is the ICWG core group for the document.
- Incorporates material into the document from both organizations, such as systems descriptions, operational context and data flow, functional and performance interface requirements, and interface control documentation plans.
- Prepares a draft version of the document and schedules and conducts a coordination meeting with representatives from ESDIS and the interfacing projects.
- Corrects the document on the basis of the coordination meeting results. Unresolved and to be resolved/to be determined (TBR/TBD) issues will also be recorded in the next draft.
- Presents the second draft of the document as a review item disposition (RID) document at an appropriate system-level review (System Requirements Review (SRR), Preliminary Design Review (PDR), Critical Design Review (CDR)).

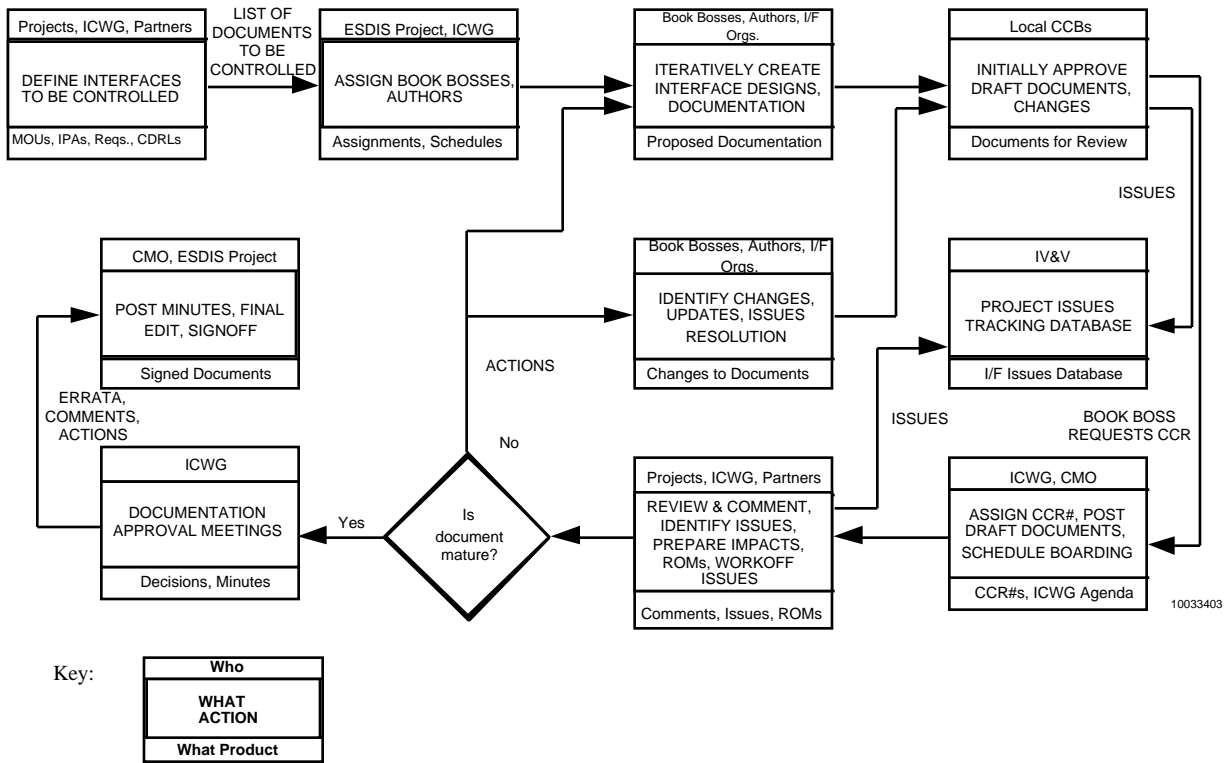


Figure 3-1. ESDIS Project Interface Documentation Flow

- Arranges a coordination meeting of the core group to review any RIDs received affecting the document.
- Changes the document to reflect RIDs, resolution of the TBRs/TBDs, and resolution of issues to the extent possible.
- Approves the document as the author organization's project baseline after discrepancies affecting it have been resolved.
- Uses the baselined document contractually to develop and implement the interface design.
- Delivers the locally baselined document to the ESDIS and to the interfacing projects for approval.

3.3.2 Interfacing Organization's Tasks

The interfacing organization performs the following:

- Participates in the ICWG core group coordination processes and in the formal review process.
- Keeps the ESDIS and the author organization aware of all costs, schedules, and performance impacts implicit in the document during development and coordination.
- Approves the baselined document.
- Provides the approval notification to ESDIS with any resulting cost, schedule, and performance impacts.
- Uses the baselined document contractually to develop and implement its interface design.

3.3.3 ESDIS Project's Tasks

The ESDIS Project performs the following:

- Participates in the ICWG core group coordination processes and in the formal review processes of the author organization and the interfacing organization.
- Facilitates interface document and ICD development through the ICWG.
- Approves the interface documentation.
- Distributes the approved version of the documents to the interfacing organizations.
- Updates the ICWG status and schedule charts, and makes them available.

3.4 Other Documentation Approval Considerations

The ESDIS representatives to the ICWG initiate the ESDIS CM process to approve the documents. The author organization and the other interfacing organization are notified of the

approval of the documents by the ESDIS Project. On receiving the ESDIS approval notification, the interfacing organization incorporates the interface details into its set of functional and performance requirements for implementation by contractors.

All documentation approval minutes and agendas are also distributed electronically to a regular distribution list to be defined by the CMO. This list includes a core group of the ICWG, project personnel, development contractors, and EOSDIS support contractors. CCRs are also distributed to the ICWG for review and evaluation.

An IRD-level document is prepared by each flight project mission to identify the operational requirements for support from the NISS. This document is the DMR or Mission-Specific Requirements Document (MSRD). These documents are considered to be IRDs by the ICWG for those requirements that affect cost, schedule, and performance of EOSDIS.

DFCDs may be used in lieu of ICDs or in addition to ICDs. The DFCD contains the same information as an ICD except that physical and protocol interface characteristics are separately controlled by standards or other ICDs.

The ICWG identifies the ICDs, project databases, and DFCDs to be prepared by each project for inclusion on the EOSDIS data interfaces diagrams. Review and approval of ICDs, project databases, and data format control books are the responsibility of the interfacing projects. Approvals must be obtained at the appropriate assigned level, including the ESDIS CCB. The projects' representatives provide current status, schedules, and issues at each ICWG status meeting.

3.5 Interface Definition Documents—Changes and Updates

After an interface document (IRD or ICD) has been placed under CM or during the approval process, the party requiring the change prepares a CCR to change the interface requirements and coordinates the particulars with the affected parties. They also pursue these changes through their local CM process. The ICWG reviews the CCR at a documentation approval or special topics meeting. Any issues, cost, schedule, or performance impacts are addressed at that time. After ESDIS approval and baselining of the CCR, the changes are made to the document. The revised document is delivered to the ESDIS Project and each affected organization. Each organization imposes the changes upon its development contractor or effort.

3.6 IRD and ICD Schedules

The ESDIS Project Systems Management Office maintains the EOSDIS Master Project Schedule, shown in Figure 3-2. The current version and status of that schedule can be obtained from that office or from the ESDIS server. This plan will not be revised solely to reflect schedule changes.

Figures C-1 and C-2 show examples of the ESDIS IRD and ICD tracking schedules. This matrix is distributed at the monthly ICWG status meeting. This schedule is updated each month at the meeting on the basis of current status provided by the attendees. The ICWG updates and distributes this schedule each month. IRD and ICD listings as shown in Figures C-4 and C-5 are maintained by the ICWG and provided as a handout at the monthly status meeting.

The ICWG IRD/ICD Status Matrix (Figure C-3) is updated monthly for ESDIS Project Management status reviews.

COUNTRIES SPACE FLIGHT CENTER CODE 405 ESDIS PROJECT		EARTH SCIENCE DATA & INFORMATION SYSTEM MASTER SCHEDULE										ORIG APPROVAL LAST CHANGE STATUS AS OF	
		1994	1995	1996	1997	1998	1999	2000	2001				11/30/93 08/19/98 08/30/98
LAUNCHES		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECS Test Version		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECS Version 1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECS Version 2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SCIENCE S/W DELIVERIES		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ECS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NETWORKS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
EIS		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
INSTITUTIONAL		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 3.2 ESDIS Master Project Schedule

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